Space Weather Technical Forecast

Issued on Friday, 06 October 2023 at 13:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-flares throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar Activity is Low, with only minor C-class flares observed in the last 24 hours. There are now nine sunspot regions on the visible disc. AR3451 and AR3452 in the north-centre disc are the two largest regions, both with some magnetic complexity. AR3451 is developing a delta spot in one of the intermediate spots, whereas the beta-gamma configuration in AR3452 is very weak. AR3454 near south centre disc, whilst having very small spots, has a somewhat complex magnetic configuration. The remaining regions all appear to be small and mostly simple at present.
Whilst there have been a couple of CMEs assessed in the last 24 hours, neither are expected to give significant impacts at Earth. A recent filament eruption and small flare from AR3454 may have launched a CME towards Earth, but we await coronagraph imagery for assessment.

Solar Wind / Geomagnetic Activity: Solar winds as observed at L1 by DSCOVR showed a weak CME arrival around 05/2140 UTC. Wind speeds have been slightly elevated varying between 420-490 km/s. Density was mainly average, becoming above average after the CME arrived with a peak of 17 ppcc. Total magnetic field strength has been mostly weak, but with brief moderate peaks after the CME arrived. The north-south component varied weakly between +6/-7 nT. Phi angle has been variable. Geomagnetic activity has been Quiet to Unsettled (Kp 0-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was at background to moderate levels. Associated 24-hour fluence was below the Active (1e8 integrated pfu) threshold with a slight rising trend. The observation at 06/0000 UTC was 8.25e6 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Mainly Low with a chance of Moderate flare activity, mainly from AR3451 and AR3452 in north centre disc.

Solar Wind / Geomagnetic Activity: A CME which left the Sun on 02 Oct arrived at Earth at 05/2140 UTC. Wind speeds are currently slightly elevated, and are expected to decline towards background levels by Day 2 (07 Oct). The High Speed Stream (HSS) from CH57 may arrive at Earth later on Day 4, with wind speeds perhaps reaching elevated levels.
Mostly Quiet to Unsettled geomagnetic activity is expected, with a slight chance of Active intervals on Day 1 (06 Oct) due to tailing CME effects. There is chance of Active intervals on Day 4 mainly due to possible HSS effects.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is most likely to remain at background levels, with a very low risk of enhancements mainly from AR3451 and AR3452. High energy electron flux (greater than 2MeV) is forecast to be at background to moderate levels, perhaps with a slight rising trend. Electron fluence is most likely to remain

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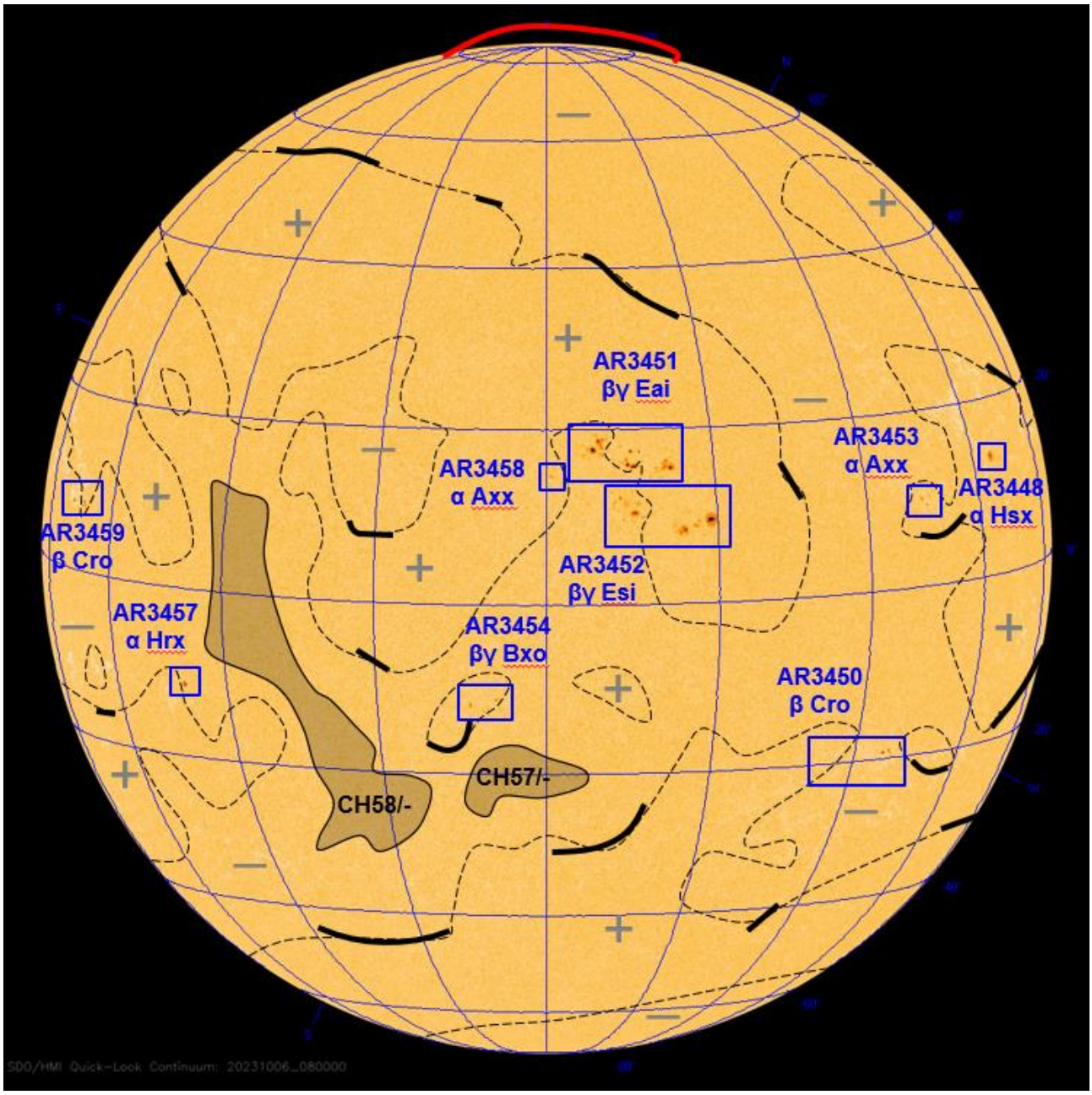
below the Active (1e8 integrated pfu) threshold also with a slight rising trend.

Figure 1. Solar Analysis Valid 06/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME which left the Sun on 02 Oct arrived at Earth at 05/2140 UTC. A further CME which left the Sun around 05/1930 UTC is mostly directed away from Earth. Whilst there may be some shock component arriving on Day 4 (09 Oct), any impacts from this are expected to be minor.

Wind speeds are currently slightly elevated, and are expected to decline towards background levels by Day 2 (07 Oct). The High Speed Stream (HSS) from CH57 may arrive at Earth later on Day 4, with wind speeds perhaps reaching elevated levels. This is a negative polarity coronal hole however, which is not favoured for significant geomagnetic response at this time of year.

Mostly Quiet to Unsettled geomagnetic activity is expected, with a slight chance of Active intervals on Day 1 due to tailing CME effects. There is chance of Active intervals on Day 4 mainly due to possible HSS effects.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No significant Earth directed CMEs currently expected, although we are awaiting imagery to assess a recent eruption.

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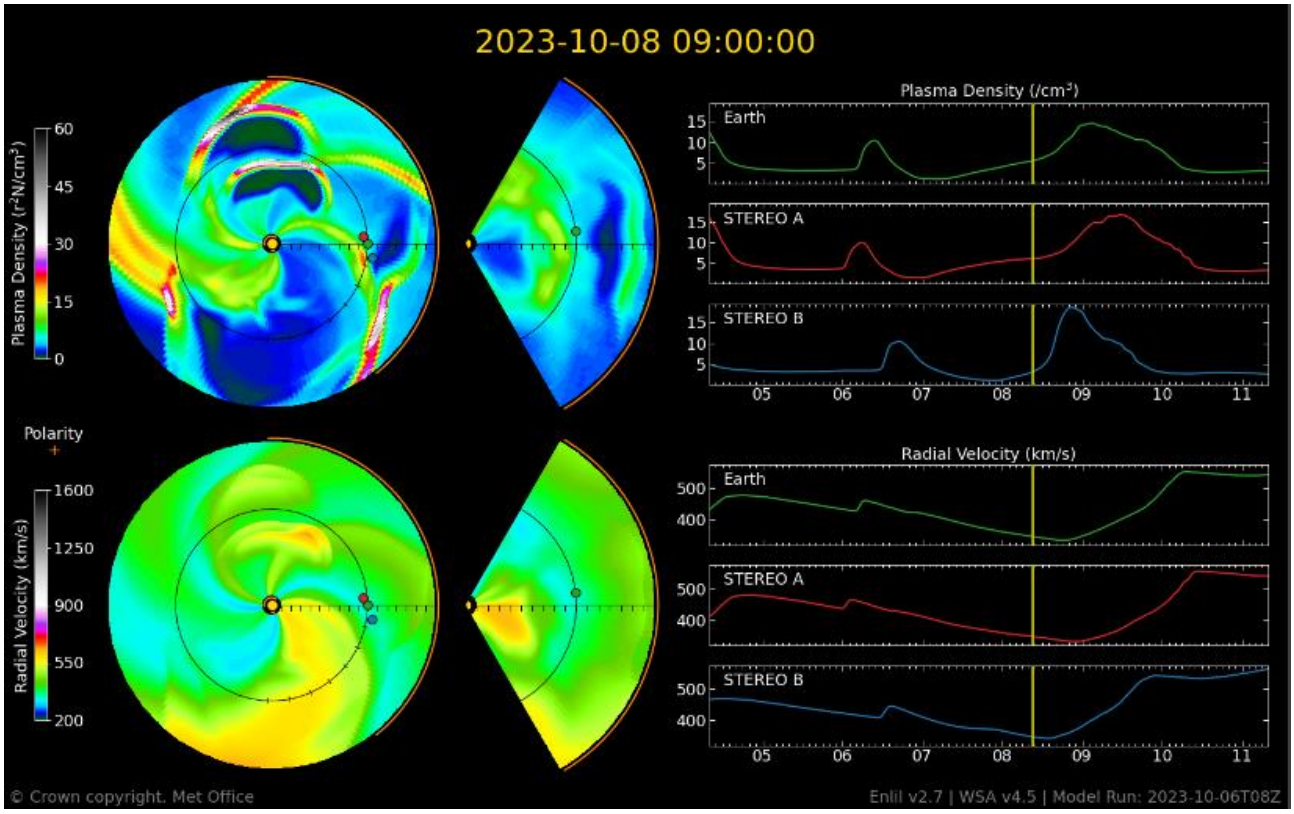
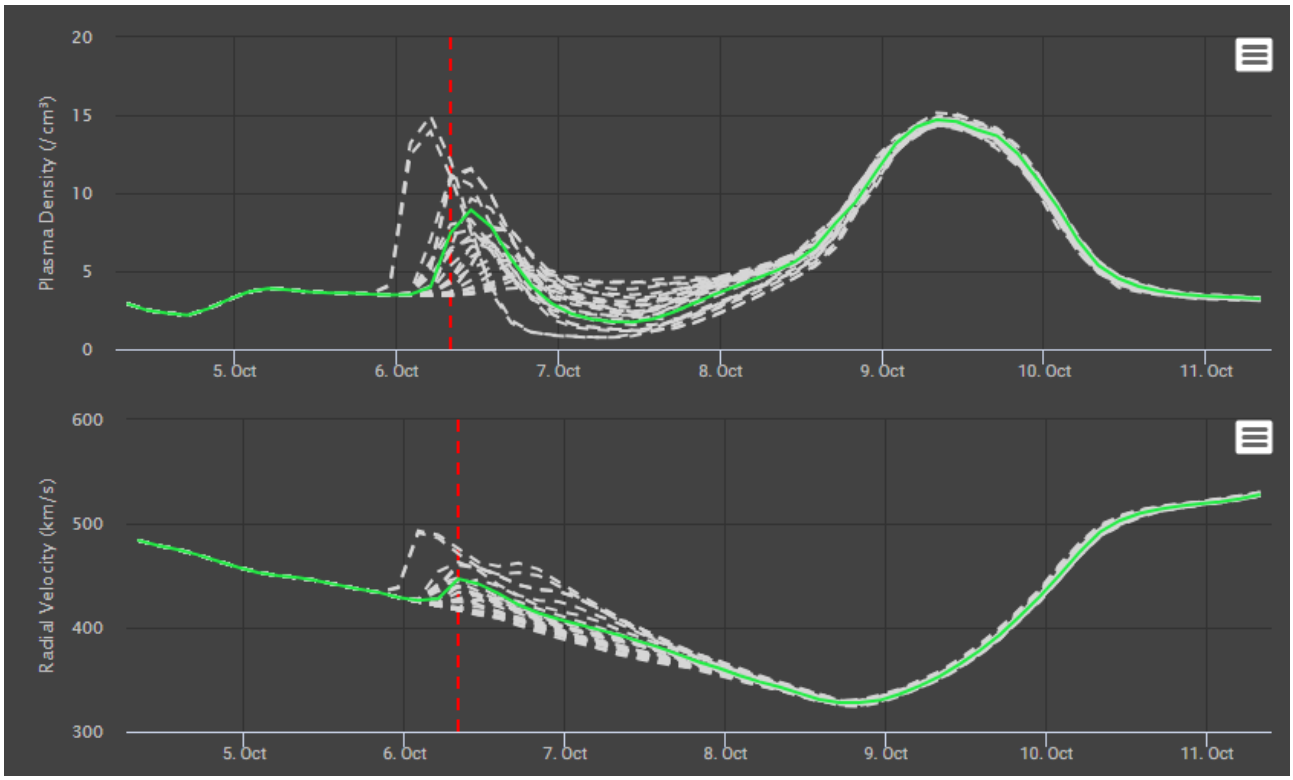
Figure 2: MOSWOC Enlil and ensemble. The main part of the CME from 05 October is expected to miss ahead, but there was a wider shock element (not modelled) which may reach Earth on 09 October with minimal impacts expected.





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Radio Blackouts - X-Ray Flares:
There are now nine sunspot regions on the visible disc. AR3451 (Eai/Beta-Gamma-Delta) and AR3452 (Esi/Beta-Gamma) in the north-centre disc are the two largest regions, both with some magnetic complexity. AR3451 is developing a delta spot in one of the intermediate spots, whereas the beta-gamma configuration in AR3452 is very weak. AR3454 (Bxo/Beta-Gamma) near south centre disc, whilst having very small spots, has a somewhat complex magnetic configuration. The remaining regions all appear to be small and mostly simple at present.

Far side seismographs suggest there are various regions on the far side due to rotate on in the coming days, however it is difficult to assess the likely activity of these regions until they become visible. As such, flare probabilities have been kept flat through this period.

Solar activity is expected to be mainly Low, with a chance of Moderate activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: X-ray trace at GOES16, with only minor C-class flaring recorded.

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Solar Radiation Storms - (High Energy Protons):
The high energy (greater than 10MeV) proton flux observed by GOES16 is most likely to persist at background levels. The main risk of any enhancement is from AR3451 and AR3452, which are both now in the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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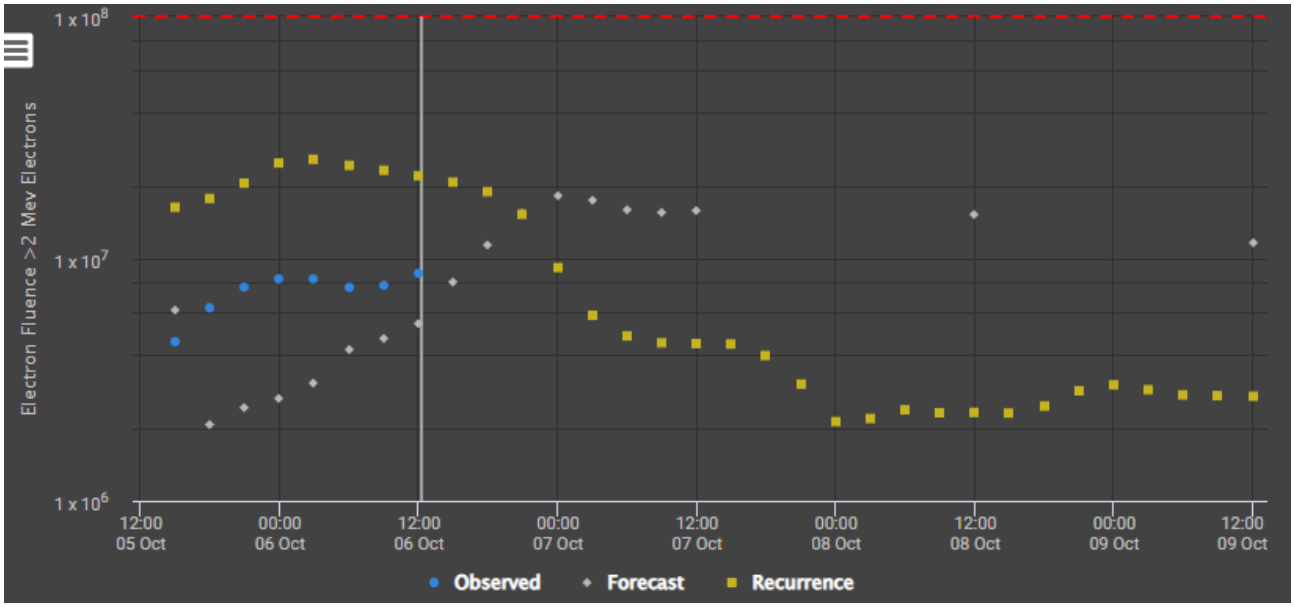
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as observed by GOES16 reached mainly moderate levels at the diurnal maximum over the last few days. After the recent CME arrival, a slight rise is possible during this period until potential CME shock and HSS effects on Day 4 (09 Oct) may cause a suppression in flux.

Electron fluence is forecast to be well below Active (1e8 integrated pfu) at first, but with a slight upward trend possible during the period. This may decline again on Day 4. Overall, fluence is considered most likely to stay below Active levels. MOSWOC REFM is forecasting a below Active trend through the next 3 days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a below Active forecast over the next 3 days, which is considered reasonable.



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